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APPARATUS FOR TRANSPORTING A SHEET-LIKE ELEMENT

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CROSS-REFERENCE TO RELATED APPLICATIONS

Reference is made to the following commonly assigned applications, the disclosure of which is incorporated herein by reference:

U.S. Patent Application Serial No. _____, filed on March 1, 2004, by Dobrindt, entitled, "TRANSPORTING AN ESSENTIALLY SHEET-LIKE ELEMENT, PARTICULARLY IN A PRINTING PRESS";

U.S. Patent Application Serial No. _____, filed on March 1, 2004, by Dobrindt, entitled, "TRANSPORTING AN ESSENTIALLY SHEET-SHAPED ELEMENT, PARTICULARLY A PRINT MATERIAL SHEET";

U.S. Patent Application Serial No. _____, filed on March 1, 2004, by Goldbeck, entitled, "CONVEYING AN ESSENTIALLY SHEET-SHAPED ELEMENT, IN PARTICULAR, A SHEET OF PRINTING MEDIUM"; and

U.S. Patent Application Serial No. _____, filed on March 1, 2004, by Dobrindt, entitled, "CONVEYING AN ESSENTIALLY SHEET-SHAPED ELEMENT, IN PARTICULAR, A SHEET OF PRINTING MEDIUM".

FIELD OF THE INVENTION

The invention relates to an apparatus for transporting an essentially sheet-like element, particularly for transporting a sheet of printing material in a printing press, preferably in a printing press operated electrophotographically. The apparatus includes at least one rotating transport mechanism for transporting the sheet-like element from a pickup site to a delivery site and delivering the sheet-like element. The rotating transport mechanism has, for receiving and entraining the sheet-like element, at least one gripper-like pickup into which the leading edge of the sheet-like element is introduced or inserted, and including at least one offset mechanism that is coupled with the transport mechanism for laterally offsetting the sheet-like element in the area of the delivery site in a direction essentially parallel to the rotational axis of the transport mechanism.

An exemplary apparatus for transporting sheet-like elements is known from U.S. Patent No. 4,431,177. Along with the possibility of laterally offsetting the sheet-like elements while they are being deposited onto a stack, it is possible, for example, to form laterally offset partial stacks that can be more easily removed and separated. The known apparatus is problematic in that the sheet-offset mechanism, which is essentially a pendulous pivoting arm, must be moved back over the center position into the starting position after each lateral offset movement. This can cause undesirable dead time for the entire apparatus.

SUMMARY OF THE INVENTION

The objective of the apparatus according to this invention is to avoid such dead time and to produce an apparatus that can be driven at higher overall operating speeds. The objective of this invention is achieved by having the sheet-offset mechanism include a roll-off roll drive element for offsetting the sheet-like element. Beneficially, such a roll drive element can rotate in one rotational direction, thus eliminating a reverse movement. As needed, the roll drive element must be turned on or off, depending upon if and when a lateral offset is desired. For such a lateral offset that transverses the transport direction by the transport mechanism, the roll drive element has an axis that is essentially laterally oriented to the rotational axis of the transport mechanism.

Following a further development of the invention, the sheet-offset mechanism is moveable from an off position into an operating position and vice versa, so that it can be turned on and off in this manner and so that, in principle, it could otherwise continue to rotate. Without rotating, the roll drive element in the operating position could beneficially also merely serve as a breaking element for the further transport of the sheet-like element by the transport mechanism, in order, for example, to absorb a tap at a stop edge in the area of the delivery site.

It is preferable to provide a sheet-offset mechanism that is coupled with the transport mechanism for a forced motion that is dependent upon the turn position of the transport mechanism. In this way, for example, the function of the sheet-offset mechanism can beneficially, always be turned on by bringing it into its operating position when the transport mechanism has reached a predetermined turn position. Furthermore, to accomplish the coupling, it can be preferable to

provide a guide rail, arranged on the transport mechanism, which guides a traveling element that is connected to the sheet-offset mechanism. The guide rail can, for example, be a component of a cam that is arranged on the transport mechanism. The traveling element can, in particular include a roller element.

A preferable and relatively simple and robust embodiment of the apparatus according to the invention provides for a roll drive element that is used for moving from or into the operating position, to be arranged on a shifter arm that can be swiveled around a rotational axis. For this, the shifter arm can be loaded with pressure, for example, by using a tension spring, in the direction of the cam. This results in a purely mechanical embodiment that can be free of delicate sensors or other such electronics. Furthermore, the shifter arm can be a two-armed lever above its rotational axis, and a drive can be arranged in the area of the lever arm opposite the roll drive element in a way that produces or increases, e.g., in addition to the aforementioned tension spring the pressure by mechanism of its own weight.

Naturally, the sheet-offset mechanism does not impede the operation of the transport mechanism. For this reason, a further development provides that the shifter arm and the drive train running from the drive to the roll drive element is guided out of the working area of the transport mechanism and is preferably angled at least one time.

As already mentioned above, a drive with an on-off control can be provided for the drive of the roll drive element, so that a selectively controlled operation can be achieved regardless of whether the sheet-offset mechanism is in the operating position or the off position.

The transport mechanism is preferably provided, in a known manner, as a rotating stacking wheel and can have several evenly distributed pickups arranged on it, especially two diametrically opposing pickups that are, in a simple case, pickup slots. One of these pickups can also be located at the delivery site, while the other pickup already takes over the next sheet-like element at the pickup site. A pickup slot can be, for example, such that the wheel body of the stacking wheel has a flat spot in the pickup area that forms the inside of the pickup slot, while from the outside, for example, a metal tongue is arranged on the

wheel body that forms the outside of the pickup slot. Particularly in such a slot configuration, it can be preferable for the outer boundary, thus, for example, the metal tongue, of each gripper-like pickup be a tab with an axial overhang over the wheel body as the working area for the roll drive element. This mechanism that this overhang forms the support for the sheet-like element, which is located in the area of the delivery site, over which the roll drive element drives the sheet-like element in the offset motion, with the tab as the abutment. This operation is particularly preferable when the sheet-like element is also still being transported further in the transport direction, something that can be aided if the inner side of the tab overhang has a reduced frictional resistance, so that the sheet-like element can slide on it out of the pickup.

As already mentioned above, in the area of the delivery site, a stop that is affixed opposite the transport mechanism, for example, a discontinuous stop bar for the passage of the transport mechanism itself, can be provided for the leading edge of the sheet-like element that is inserted in the pickup. The sheet-like element is hereby restrained, while the transport mechanism continues moving and is thus released for depositing by the pickup.

In order to improve and, particularly, align the guiding and handling of the sheet-like elements, it is preferable that there be several coaxial transport mechanism that are separated from one another. It is preferable for two transport mechanisms to be arranged laterally reversed with respect to a mirror surface that is perpendicular to the rotational axis. Correspondingly, it is preferable for each transport mechanism to be allocated a sheet-offset mechanism, and for the sheet-offset mechanism to be operationally synchronized with each other and preferably coupled with each other.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment from which additional features according to the invention can be derived, but to which the scope of the invention is not limited, is shown in the drawings in which:

FIG. 1 is a section of the apparatus according to the invention with contours of elements in the surround field of a rotating transport mechanism; and

FIG. 2 is a top view of the elements according to FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a sectional view of an apparatus according to the invention, in which a rotating stacking wheel 1 for the transport and redirecting of a sheet-like element 7, which is operable on a shaft 6, can be seen in a side view. The stacking wheel 1 has two guide tongues 2 that are arranged diametrically opposite one other, which, together with the wheel body - which also could also be configured like spikes - always form a pickup slot for a sheet-like element 7. Each time a single sheet-like element is transported by sheet rollers 3 into a pickup slot in the area of an upper pickup site, the leading edge of the sheet-like elements should not push all the way to the end of the slot, in order to avoid damage. In the depiction in FIG. 1, the sheet-like element picked up in this manner is transported to a delivery site by the rotation of the stacking wheel 1 in a clockwise direction, at which point it strikes a stop bar 14, clears the pickup slot as a result of a further rotation of the stacking wheel 1, and is deposited onto a stack 5. FIG. 1 shows an example of a sheet-like element 7 during transport shortly before it reaches the stop bar 14. It should be noted that in this position, the sheet-like element, and even its trailing edge, already has been released by the sheet rollers 3.

The stacking wheel 1 is also allocated a sheet-offset mechanism that, if desired, can give every sheet-like element 7 a lateral offset shortly before it reaches the stop bar 14, namely, as depicted in FIG. 1, in the direction away from the drawing plane. The sheet-offset mechanism includes a shifter arm 12 that is pivotally mounted on a bearing support 11 around a horizontal rotational axis 9 that is parallel to the shaft 6. The shifter arm 12 is urged in an upward direction with a tension spring 8, which is mounted on a device frame 17, similar to the bearing support 11. This upward urging is further reinforced by the lever arm force of a two-armed lever, effected by the weight of the drive motor 10. A roller 18 on a circumferential guide rail of a cam 4, which rotates together with the stacking wheel 1, inevitably comes to rest in the direction of this urging. By an eccentric or non-circular profile of the cam 4, the shifter arm 12 is then always pressed downward against its spring load when a pickup slot nears the stop bar 14. Accordingly, a roll drive element 16 for the lateral offset can act upon the

approaching sheet-like element 7 in the pickup slot, with the element being arranged on the free end of the shifter arm 12. This roll drive element 16 is rotatably driven by a coupling 20 and shafts 13 and 19 (see especially FIG. 2) by a sheet-offset drive motor 10.

FIG. 2 shows a top view of the apparatus according to FIG. 1. The same components are labeled with the same reference numbers as in FIG. 1.

In this top view, it should be noted that the shifter arm 12 is configured as one angle member, and that the drive shafts 13 and 19 are arranged in parallel so as to result in a parallel offset between the shifter arm 12 and the stacking wheel 1. The gear drive 15 interconnects the shafts 13 and 19 in order to drive the roll drive element 16 in the immediate area of the stacking wheel 1; however, the larger portion of the shifter arm 12 and its bearings are located in order not to impede the operation of the transport mechanism.

In addition, it shall also be noted, in particular, in FIG. 2 that the guide tongue 2 is broadened like a tab, so that it protrudes axially over the body of the stacking wheel 1, in order to be able to serve as a support and abutment for the operation of the roll drive element 16.

The apparatus thereby depicted essentially operates as follows:

Shortly before the sheet-like element 7 that is to be deposited is pulled against the stop bar 14, the roll drive element 16, is automatically lowered by the cam 4, that is located on the stacking wheel 1.

After the roll drive element 16 has touched the sheet-like element 7 and lies on the protruding tab of the guide tongue 2, the rotation of the roll drive element 16 can begin. This rotational motion is controlled by the drive motor 10.

During this lateral-offset motion, the stacking wheel 1 can also continue to rotate if there is a slide surface on the inside of the tab that significantly reduces the friction coefficients between the sheet-like element 7 and the tab, as compared to the friction coefficients between the roll drive element 16 and the sheet-like element 7.

Finally, the sheet-like element 7 that is to be deposited is guided further out of the stacking wheel 1, and the lateral movement also occurs.

It is important, however, that the protruding tab length in the direction of rotation is adequate, so that there is a sufficiently large window of time for the required lateral-offset path.

The contact of the roll drive element 16 with the sheet-like element 7 that is to be deposited can also be used simultaneously as the stop element for the sheet-like element 7, so that the subsequent counter-pull of the sheet-like element 7 against the stop bar 14 requires very little energy, and a rebound of the sheet-like element 7 from the stop bar 14 is thereby excluded.

After the sheet-like element 7 has undergone its lateral offset and come to a stop, the roll drive element 16 is again automatically lifted from the sheet-like element 7 by the cam 4, so that the entire slot area is again cleared for the next sheet-like element 7.

Further rotation of the stacking wheel 1 causes the protruding tab to move below the roll drive element 16.

Generally, it shall be noted that only one stacking wheel 1 is shown in the drawing. For the depositing process, however, it is preferable to have at least two stacking wheels 1 and, subsequently, also two roll drive elements, so that the sheet-like element 7 that is to be deposited cannot get twisted.

So that two drive motors 10 are not required for the two roll drives, one can conceive of a bridge element located between two stacking wheels 1, which connects the two lever arms of the roll drive elements. Finally, then, a belt drive, for example, can connect and uniformly drive the two roll drive elements, thereby eliminating the necessity to synchronize the two roll drive elements.

In this lateral-offset process that has been described, it shall be noted that the sheet-like element 7 is already transported out of the sheet roller pair 3 before the lateral offset takes place.

With respect to this purpose, the cam size shall be configured in a way that provides adequate time for the entire depositing process for all sheet formats.

The invention has been described in detail with particular reference to certain preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.